Vehicle Systems Working Group

Report to
Revolutionize Aviation Subcommittee

M. O. Anderson
Vehicle Systems Task Force

25 February 2003
Washington, D.C.

Vehicle Systems Working Group
Report to Revolutionize Aviation Subcommittee

Introduction

- Initial actions taken to form Strategy Team and Vehicle Systems Task Force
- 4 November 2002 Strategy Team / Task Force Interaction (Tysons Corner)
- 5-6 December 2002 Strategy Team / Task Force Interaction (Cincinnati)
- 6-10 January 2003 Workshops (Reno)
- Current Status

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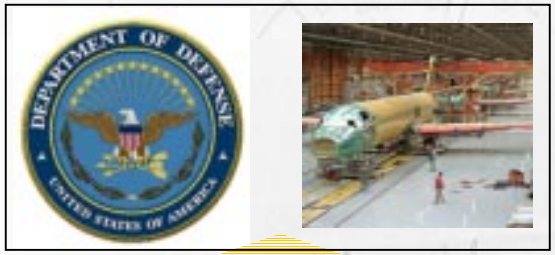
Technology Transfer



Flight Validation

Advanced Vehicle Concepts

Technology Maturation & Integration

Ultra-Efficient Engine Technology

21st Century Aircraft Technology

Quiet Aircraft Technology

Fundamental Technology & Tool Development

Breakthrough Vehicle Technologies

Propulsion & Power

Flight Research

Vehicle Systems Task Force Membership

- **Platform Integrators / Airframers**
  - Lockheed Martin — Paul Bevilaqua
  - Northrop Grumman — Tom Weir
  - Boeing — Mark Anderson
- **Propulsion**
  - GE — Mike Benzakein
  - P&W — Walt Smith
- **'General Aviation'**
  - Eclipse — Don Taylor
  - Gulfstream — Rick Trusis
- **'GA Propulsion'**
  - Honeywell — John Meier
  - Williams — Scott Cruzen
- **Military Aviation**
  - USAF (AFRL) — Bill Borger
  - USN (NAVAIR) — Tim Healy
- **Academia**
  - MIT (Propulsion) — Alan Epstein
  - Stanford (Airframe) — Ilan Kroo
- **Unique**
  - AeroVironment (HALE) — Bob Curtin
  - Sikorsky (Rotorcraft) — Mark Miller/Mike Torok

Initial Proposal for Task Force Schedule

20 Sep 02	**NASA Request to form Vehicle Systems Task Force.**
Week of 14 Oct 02	**Initial Strategy Team working sessions.**
4-5 Nov 02	**1st Strategy Team / Task Force interaction to set direction.**
3-5 Dec 02	**Level 3 Workshop**
5-6 Dec 02	**2nd Strategy Team / Task Force interaction to review planning.**
20 Dec 02	**Interim report due back to Strategy Team from Task Force.**
9-10 Jan 03	**Reno Workshop in conjunction with AIAA Aerospace Sciences meeting**
Week of 20 Jan 03	***Updated plan provided to Task Force by Strategy Team.***
Week of 10 Feb 03	**Final Task Force report to Revolution Aviation Subcommittee.**
26-7 Feb 03	**Subcommittee report to Aerospace Technology Advisory Committee.**

Actions Posed 5 Dec 02 for Task Force Consideration

1. Offer feedback to NASA Strategy Team on VSTF expectations.
2. Provide input to the planning process.
   a) Provide interim feedback on current 'go forward' plan.
   b) Provide opinion of role of vision vehicles (technology tied to goals, or technology driving vehicles, which tie to goals.
   c) Recommend appropriate scope, focus, and execution for new Vehicle Systems Program.
   d) Assess planning process being used by Strategy Team.
3. Provide national aerospace community perspective
   a) Expectations for Vehicle Systems Program
   b) Provide guidelines for useful output
   c) Engagement recommendations
   d) Technology content for roadmaps.
4. Offer opinion on strategy by which Vehicle Systems goals are selected.
5. Assist NASA in gaining increased credibility with key stakeholders.
6. Assist in definition of attributes of a 'B-47 type breakthrough.'

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Focus of 6 Dec 02 Working Session

- **Preparation for our 10 Dec 02 feedback to Strategy Team.**
  - Feedback on what we heard.
  - Recommendations
- **Preparation of Immediate Advice for NASA.**
  - Charts for use with OMB
  - Closing the planning process
  - Program content
  - Definition of end product of planning process
- **Long lead preparation for our early 2003 report to Revolution Aviation Subcommittee**

Task Force 10 Dec 02 Response

- Offer feedback to NASA Strategy Team on VSTF expectations.
- We would expect (1) to see NASA's presentation of the end state vision, then (2) to have the opportunity to make input to NASA, next (3) to review the results of the planning process, and finally (4) to support and endorse the plan.

Task Force 10 Dec 02 Response (cont)

- Provide input to the planning process.
  - Provide interim feedback on current ‘go forward’ plan.
  - Go forward plan today is a combination of a baseline plan (old program recast in new template) and an incomplete planning process. We recommend diverting the core NASA Strategy Team from the GOTCHA chart exercise to permit moving forward for closure of the planning process. We propose an alternative approach.

Task Force 10 Dec 02 Response (cont)

- Provide input to the planning process.
  - Provide opinion of role of vision vehicles (technology tied to goals, or technology driving vehicles, which tie to goals.

  - Role of vision vehicles: Vehicles should drive technology goals and prioritization. Vehicles and the technologies they spawn should enable achievement of big goals that support NASA's vision for the Vehicle Systems Progra. Concept vehicles are desirable as a way to focus development efforts. You shouldn't hide this from OMB, as vision vehicles ('integrating concepts') don't automatically need to lead to flight hardware, and we don't assume that they will lead to real vehicles. We are open to idea that flight experiments might be needed to validate technology. We don't understand or accept the need to tie one vehicle to one center. The Integration Concept (IC) leader should report to Washington and draw his budget from HQ. You don't necessarily care where he / she sits, but it seems key that the IC leader should have budget authority.

Task Force 10 Dec 02 Response (cont)

- Provide input to the planning process.
  - Recommend appropriate scope, focus, and execution for new Vehicle Systems Program.
  - First, you need to state at the highest level what the Vehicle Systems Program should try to accomplish over the next 3-5 years. This could be articulated along lines of the Red Team's goal and in terms of stretch goals for each vehicle class. You need to have a vision for VSP that is linked to but separate from higher level NASA vision.

Task Force 10 Dec 02 Response (cont)

- Provide input to the planning process.
  - Assess planning process being used by Strategy Team.
  - You must do work identified above successfully, and then can return to detailed planning process later. You must avoid an end state in which there are 500 technologies with no way to differentiate relative worth among them. You are now doing useful brainstorming, but should set that task aside now. To prioritize you need to show what you will do to meet your vision (which has not yet been specified). We support the 'vision vehicle' integrating concept idea. Do remember that vision vehicles are general classes, and multiple specific vehicles might lie within each class. There is no sizzle in a broad class of vehicles, but there will be sizzle in a specific vehicle, so you need to move to requirements / mission / concepts. NASA needs to be involved and in control, but should entrain outside expert participation in a set of focused workshops. This should be a 3-5 day exercise. The output of each workshop would be a what is doable by when.

Task Force 10 Dec 02 Response (cont)

- Provide national aerospace community perspective
  - Expectations for Vehicle Systems Program
  - Provide guidelines for useful output
  - Engagement recommendations
  - Technology content for roadmaps.

  - Your roadmaps should consider dimensions representing both vehicles and overall goals.

Task Force 10 Dec 02 Response (cont)

- Offer opinion on strategy by which Vehicle Systems goals are selected.

- No input made by Task Force

Task Force 10 Dec 02 Response (cont)

- Assist NASA in gaining increased credibility with key stakeholders.
- You need to maintain political support of your centers, funders, and customers (both external and internal NASA customers). You need a sound program plan 1st, then an advocacy plan supported by a marketing effort. Your advocacy plan should be responsive to all 3 stakeholders. The VSTF might be able to help with your advocacy plan.

Task Force 10 Dec 02 Response (concluded)

- Assist in definition of attributes of a ‘B-47 type breakthrough.’
- First define the goals / capabilities / mission / requirements for the 5-10 vehicles thru the focused workshops, because that is where the sizzle will be. Any breakthrough will result as a byproduct of executing the plans for each vision vehicle.

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Status as of 10 Dec 02

- **Much good work has been done in replanning the Vehicle Systems Program. Now is the time to drive forward and complete the task.**
- **NASA Strategy Team members are bringing their superb talents to bear and are working well together in the service of our nation.**
- **The Vehicle Systems Task Force is working effectively with the Strategy Team.**
- **We recommend that the NASA Strategy Team and Vehicle Systems Task Force (VSTF) meet again in person the week of M, 20 January 2003.**
  - Focus then on product of planning process, not the process itself.
  - Meet together the 1st day.
  - VSTF only the 2nd day.
- **Now is the time to take action:**

'To ensure the preeminence of the United States in aeronautical vehicle technology.'

Recommendations for OMB Engagement

Key elements of presentation

- Vision
- Planning process
- Plans (the product of the planning process)

Critical aspects

- Why is this important?
- What is your product?
- What is long term vision/plan? Where are we going?
- Why is this good for USA; how will it benefit the public?
- What will be accomplishments of your $600M annual plan?
- How does your plan support NASA goals?
- Does industry support this plan? Does academia?
- What will happen if you don't get the money? Anything?

Desired outcome

- Endorsement of plan by OMB management
- FY 04 budget as requested

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The NASA Mission

To understand and protect our planet

To explore the Universe and search for life

To inspire the next generation of explorers

. . . as only NASA can

Agency Level Goals

- Strategic Goals tied to each Mission
- Supporting Goals necessary to achieve Strategic Goals
- Success in achieving goals will enable NASA to achieve Mission

Strategic Budget Themes

- Themes Linked to goals they contribute to
- Multiple Themes may support a goal

Theme Objectives

- Tied to each Goal through Themes
- Success of Themes in achieving their objectives will enable NASA to achieve Goals

Performance Measures

- Long-term outcome measures
- Annual output measures indicate progress towards achieving long-term outcome measures

GOTCha Example

Goals	Objectives	Technical Challenges	Approach
Reduce production of CO2 by 50% from conventional engines	Reduce fuel burn	Decrease TSFC by x%	Component efficiency improvements
			Improved PAI Engine architecture
		Increase propulsion system T/W by	Increase T3
			Structural analysis tools
		Increase L/D by	PAI
			Vehicle Drag Reduction High aspect ratio
		Decrease vehicle empty weight fraction by	Strength and cycle fatigue
			Structural analysis tools
	Develop alternate fuels/propulsion systems to generate zero CO2	Advanced vehicle concepts	Advanced PAI
			Efficient large volume vehicle concepts
		Advanced propulsion concepts	Hydrogen powered
			Electric powered Anti-matter powered
	Trajectory optimization		

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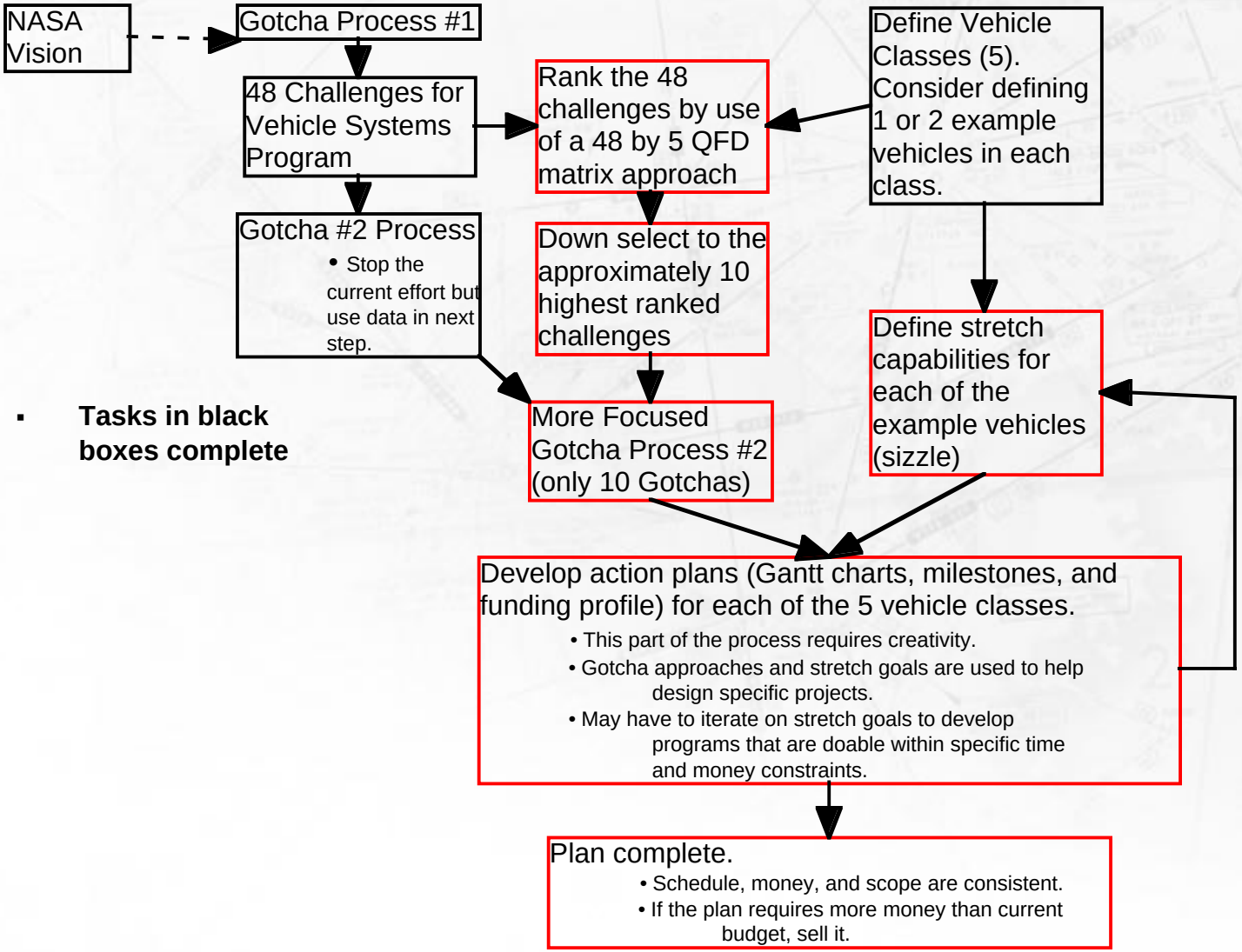

- **Tasks in black boxes complete**

‘Red Team’ Membership

Lt. Gen. Thomas Ferguson, USAF (ret)

Prof. William H. Heiser, USAF Academy (ret)

Mr. Leland Coons, VP Engineering, Pratt and Whitney (ret)

Dr. Donald Dix, Director, Advanced Technology, ODDR&E (ret)

Prof. Eli Reshotko, Case Western Reserve University (ret)

Mike Hendersen, Boeing Commercial (ret)

Dr. Richard Bradley, Director of Engineering, General Dynamics (ret)

Ray Morgan, Aerovironment (ret)

Roy Harris, NASA Langley (ret)

Lou Sutherland, Wyle Labs (ret)

'Red Team' Guidance

- **One objective of NASA: "Preservation of the role of the United States as a leader in aeronautical…technology" --*National Aeronautics and Space Act of 1958***
- **A suitable (and needed) mission statement for VS consistent with this objective is "To ensure the preeminence of the United States in aeronautical vehicle technology"**
- **VS plans and programs should be aimed at carrying out this mission**
- **Continual assessment of competitive position is required to evaluate adequacy of VS plans and programs**

Desirable Vehicle Systems Program Characteristics

- Defensible (to funders)
- Integrated (across program)
- Simplified (understandable)
- Focused (on goals)
- Innovative (technologically)
- Linked (to product users)

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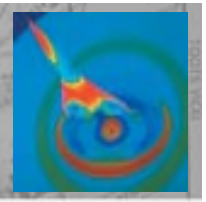
Summary

- NASA Strategy Team and Vehicle Systems Task Force worked together effectively
- NASA has undertaken a major effort to reshape Vehicle Systems Program
- Task Force enjoyed significant access to Strategy Team planning process, but was able to gain little insight over 1st 4 months of effort into product of planning process.
- Strategy Team seemed pleased with support from Task Force.
- Strategy Team was able to blend our inputs with those of Red Team and to balance our requirements for inputs with workload challenges of the onging NRC review.
- Task Force awaits further direction from Revolutionize Aviation Subcommittee.
- **Regardless…..now is the time to take action:**

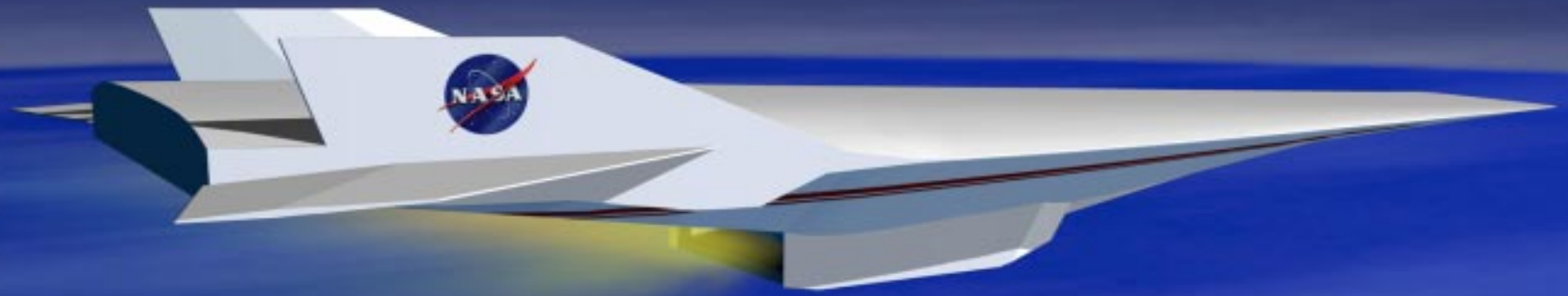
'To ensure the preeminence of the United States in aeronautical vehicle technology.'

The Role of the Aerospace Technology Enterprise



To pioneer and validate high-payoff technologies:

To improve the quality of life;
To enable exploration and discovery;
To extend the benefits of our innovation throughout our society.



Our success is measured by the extent to which our results
Improve the quality of life and
Enable exploration and scientific knowledge